Maastricht University

Bootstrap inference for environmental trends

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Chapter 6

Valorization

This dissertation makes a contribution to the academic literature. In addition, it bears value for society which we discuss in the following. In general, the methods proposed in the previous chapters increase the set of available statistical tools to analyze economic and, in particular, environmental developments. In addition, the applications which are presented in this thesis deepen our understanding of important topics in geology and environmental economics. All conclusions drawn from these applications are relevant to the understanding of climate change.

As illustrated in Chapters 2 and 3, we propose a set of trend analysis tools which deepens our understanding of important atmospheric gases. In an application to atmospheric ethane we learn about the presence of a trend reversal pattern which can be associated with the increase of shale gas extraction in the United States. This is an important finding since before this recent rise there were long-term successful measures in place which lead to a steady reduction of the indirect greenhouse gas. With the increased activity in shale gas extraction, these measures were more than offset in less than 10 years.

In addition to being an indirect greenhouse gas and contributing to the formation of ground-level ozone, atmospheric ethane measurements can be used to study another important pollutant which is atmospheric methane. The latter is hard to measure because it is emitted by both anthropogenic and natural sources. Atmospheric ethane, however, is mostly coming from anthropogenic activities which also emit methane in a constant proportion. This is why developments of atmospheric ethane can give us a good indication of the fraction of methane stemming from anthropogenic sources.

The application of the proposed tools is not limited to the analysis of atmospheric gases. They are valid under very general conditions and can therefore be used for the analysis of various other time series of interest. In order to facilitate the analysis, we make R code implementing our methods freely available on our websites.

The contribution of Chapter 4 to the analysis of fundamental price drivers in the European Emission Trading Scheme provides a final point worth mentioning in this addendum. The EU ETS is the European Union's flagship policy for regulating carbon dioxide emissions. It currently covers around 45% of all greenhouse gas emissions in the EU, and it is bound to be expanded as part of the EU's recent Green Deal strategy. Depending on the price of allowances, there is an incentive for firms to engage in short-term mitigation (e.g. fuel switch from coal to gas) and to investment in low-carbon technologies. Economic theory suggests that this is done in a cost-effective way, which is why – in face of more ambitious climate targets and higher policy costs – this policy instrument becomes increasingly important as a tool for society in the presence of climate change.

However, the cost-effectiveness of the EU ETS crucially hinges on efficient price formation, which depends on regulation and policy design as well as the behavior of market participants. In the last years, many concerns have been raised that price formation is inefficient for various reasons, leading to market distortions. If that would indeed be the case, additional measures to correct these distortions are essential to guarantee the proper functioning of the EU ETS. This is why understanding the price development of allowance prices in this scheme is of crucial importance, in particular, after the long period of unexpectedly low prices. In that regard, the results of Chapter 4 suggests that a complementary measure like a carbon price collar could be beneficial to stabilize prices. This recommendation is particularly relevant for the further development of the EU ETS, and thus for the EU's prospects of achieving its ambitious climate targets.